quitoes" (not knowing that the terms gnats and mosquitoes are applied indiscriminately to any biting species of Culicidæ), and, what is more important, the gnats belonging to the genus Anopheles, though far from extinct in England, have ceased to disseminate ague as formerly.

Mr. Austen informs us that there are practically only six families of blood-sucking flies in England, Chironomidæ (midges), Culicidæ (gnats or mosquitoes), Simulidæ, Tabanidæ (horse-flies), Muscidæ, and Hippoboscidæ. In Chironomidæ and Muscidæ the habit is exceptional, occurring in a few species only, and, except in the Muscidæ (and perhaps the Hippoboscidæ), the habit is confined to the females. Mosquitoes, however, are also capable of subsisting on the juices of plants.

The illustrations in the present work are considerably enlarged, and with few exceptions represent only females. The originals have been prepared for exhibition in the north hall of the Natural History Museum. The letterpress consists of a brief general account of each family, and a notice of the chief characteristics, habits, and localities of the various species figured, technical descriptions, however, being omitted. Little has been done in England to popularise the study of Diptera, and there are very few illustrations of the species; so we welcome this excellently arranged and illustrated book as a useful contribution to our knowledge of the British Diptera.

W. F. K.

Gehirn und Rückenmark. Leitfaden für das Studium der Morphologie und des Faserverlaufs. By Dr. Emil Villiger. Pp. vii+187; illustrated. (Leipzig: W. Engelmann, 1905.) Price 9 marks.

THERE is no department of medical science in which greater advances have been made within the last twenty-five years than in that of diseases of the central nervous system. This is mainly a result of increasing precision in our knowledge of the complicated labyrinth of the various groups of nerve-cells and nerve-fibres which compose the essential mechanism of the nervous system. The complexity of the subject renders it a task of some difficulty to the medical student, whether he be undergraduate or post-graduate, who is desirous of acquiring that thorough grasp of nervous anatomy on which the successful solution of diagnostic problems must of necessity depend. To such students as are able to read German we can cordially recommend Dr. Villiger's book. Within the compass of 177 pages the author discusses in lucid style the main facts of the morphology of the brain and spinal cord, and describes all the more important tracts of nerve-fibres. An excellent series of illustrations, many of them original, illuminate the text, whilst we are glad to observe that the author evidently describes the gross anatomy as if demonstrating the actual brain, using the diagrams as accessories. In this way the practical value of the book is undoubtedly enhanced.

Commencing with an account of the embryological development of the nervous system, the author proceeds to discuss in detail the naked-eye anatomy of the brain and spinal cord, with their surrounding membranes. An interesting historical account is given of the successive stages in the methods of neuro-histology, but we are surprised to find no reference to Marchi's well-known osmic acid method of staining recently-degenerated nerve-fibres, a method which since its introduction more than ten years ago has done more than any other to clear up our knowledge of nerve-tracts. Nor is any reference made to the still more recent methods of Cajal and of Bielschowsky for the staining of neurofibrils. Doubtless these omissions will be rectified in a future edition.

An excellent description is given of the microscopic characters of the various regions of the cerebral cortex, the basal ganglia, the cerebellum, pons, medulla, and spinal cord. The cranial nerves are discussed with remarkable clearness, the diagrams illustrating this part of the book being particularly good. Finally, there is a concise account of the main sensory, motor, and association systems of fibres in the central nervous organ. The book is well indexed.

Dr. Villiger is to be congratulated on having produced an excellent book. Not only does it amply fulfil its avowed scope of serving as an introductory guide to the student, but it will be read with pleasure and profit by many neurologists.

Naturkonstanten in alphabetischer Anordnung. By Prof. Dr. H. Erdmann and Dr. P. Köthner. Pp. 192. (Berlin: Julius Springer, 1905.) Price 6 marks.

THIS handy little work is a book of constants intended for the use of chemists and physicists. It differs from others of its kind chiefly in the fact that the information in it is arranged alphabetically, with a marginal thumb index for rapid reference.

The work of the compilers has on the whole been very well done. Only one value of each constant is given, and usually no reference is made to the source or author. The work of the last ten years has, however, been incorporated to a much greater extent than is usual in books of this kind, and even data only published during the past twelve months are included. The plan adopted by the compilers should conduce to a considerable saving of time in looking up information. We think the book should be of especial value to chemists, as the data necessary in quantitative analysis are dealt with in a specially complete manner. There are also tables giving for each element and its most important compounds the atomic or molecular weight, density, melting point, boiling point, thermochemical constants, &c., together with a five-figure logarithm table for computation purposes. Details as to the most important spectroscopic features of each substance are given in a very handy form, the conditions as to the particular spectrum being clearly specified. Another very useful table containing data not often easily accessible is that of the electrochemical equivalents of the metals.

It is difficult in the time possible for a reviewer to spend on a book of this kind to detect many of the errors nearly inevitable in a first edition. The plan adopted by the writer has been to put the work for a while on his reference shelf, and turn to it frequently when looking up constants, verifying from other sources the data thus obtained.

Obvious slips are the value of $\frac{1}{2}\pi$, given on p. 114 ten times too small, the E.M.F. of the Clark cell, given on p. 40 as 0.60735 volt, and several misprints among the tables of English weights and measures, where the gallon is included under measures of surface.

Other inaccuracies are the value for the melting point of palladium, given as 1950° C. instead of 1525° C. ± 25, of nickel, given as 1500° C. instead of 1427° C., and of wrought iron, given as 1600° C. instead of 1500° C.

One rather unfortunate tendency of the work is to deal in a multiplicity of units. There is, for example, no need to speak of "hektowatts," and it is certain that some of the subdivisions of the millimetre dealt with in the chapter on units are only confusing and rarely met with in practical work. Then, also, the units other than metric given in the book as at pre-

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sent in use in various countries are not always those ordinarily adopted. In Japan, for example, the present standard of mass is the "Kwan," prototypes of which were recently standardised at Sèvres.

We can, however, cordially recommend the book, which should prove very useful. J. A. H.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Thermodynamic Reasoning.

IN the address delivered by Principal Griffiths at York, which is printed in your issue of August 9, I read: "Prof. Armstrong remarks that it is unfair to 'cloak the inquiry by restricting it to thermodynamic reasoning, a favourite manœuvre with the mathematically minded.' He adds that such a course may satisfy the physicist but 'is repulsive to the chemist.' The inquiry, 'Why is the application of thermodynamic reasoning repulsive to the chemist?' naturally suggests itself."

This statement shows a strange misapprehension of my position. I have taken exception *to the restriction of the inquiry* to thermodynamic reasoning, not in any way to the mere application of thermodynamic reasoning. My objection was to formula worship. I still and shall ever object to it, for it is the bane of progress. As I said at York, physicists too nearly resemble the visitors to London who walk along the Strand and Shaftesbury Avenue and are content to look at the theatres from outside; they resemble those who admire the British Museum building but have no desire to examine the treasures within it.

If I did not misunderstand him, Mr. Whetham implied at York that it was enough for him that a certain thermodynamic expression was valid: what the condition termed osmotic pressure really is—whether a true pressure or whether, as I suggested, a negative pressure or thirst—mattered not a jot. A certain mathematical thermodynamic picture being painted, no other artist need apply. This does not seem to me to be the attitude a scientific inquirer should adopt. Whether I represent the opinion of chemists matters little: personally I am not willing to remain outside the Museum: I shall go inside, if possible, trusting that in some faint degree I may be able to appreciate the wonders within it.

At present, progress is not a little hampered by the fact that chemists and physicists cannot wander through the museums of nature looking eye to eye in complete sympathy with one another: surely we are destined to be the closest of friends; more should be done to cultivate an understanding; a confusion of tongues has arisen which keeps us apart: we must both strive to speak a simpler language. Together

> "Let us inspect the lyre and weigh the stress
> Of every chord and see what may be gain'd
> By ear industrious and attention meet."

HENRY E. ARMSTRONG.

IT is the strength and weakness of thermodynamical reasoning that it connects different phenomena without the aid of theories about the mechanism by which the connection is effected.

In the discussion at York, Prof. Armstrong put forward certain arguments in favour of the view that solution is a chemical phenomenon, and osmotic pressure due to an attraction of the nature of chemical affinity. He used these arguments in an attempt to invalidate van 't Hoff's thermodynamic theory, which shows that, from the observed solubility phenomena of volatile substances, it follows that the ideal osmotic pressure of a number of particles of such substances in a dilute solution must be equivalent to the pressure which the same number of particles would exert as a gas occupying the same space.

In my reply to Prof. Armstrong I pointed out that the thermodynamic theory is quite independent of the particular view we may adopt as to the fundamental nature of solution, and the *modus operandi* of osmotic pressure. Osmotic pressure may, as van 't Hoff himself supposed, be due to the impacts of the dissolved molecules; it may, as Prof. Armstrong believes, be caused by chemical affinity; it may be produced by some other undiscovered cause. The thermodynamic reasoning avoids all such hypotheses, and connects directly the experimental facts of the solubility of gases with the osmotic pressure they would exert against a perfect semipermeable membrane in dilute solution.

I have never suggested that the ultimate nature of solution was a matter of no interest. It is the question of most supreme importance now outstanding in these subjects; but let us clear the issue before attacking it. We must recognise clearly that the relations indicated by thermodynamics and confirmed abundantly by experiment are among the established facts to be explained by a theory of the nature of solution.

It is for this recognition of the true position of the problem that I contend. The thermodynamic reasoning which connects the ideal osmotic pressure with experimental phenomena is not in question. That reasoning is confirmed by measurements of actual osmotic pressures and of freezing points. It can only be invalidated by a general attack on thermodynamic theory, such as that which was foreshadowed in Mr. Campbell's recent reconnaisance-in-force. I do not think any such attack has much chance of success. Osmotic phenomena seem to me to be entrenched in the strongest part of the vast lines occupied by the science of thermodynamics.

Cannot Prof. Armstrong agree to accept the thermodynamic reasoning as confirmed by experiment, and pass on to the further problem? Personally, I think that the evidence at present available is on the whole in favour of the chemical theory of solution and osmotic pressure—the theory which Prof. Armstrong supports; but there is work to be done before such a conclusion can be taken as established. May we not agree that it is better both for physicists and chemists to do such work than to waste their energies in attacking with inadequate artillery the well-fortified citadel of thermodynamics?

W. C. D. WHETHAM.

High Borrans, Westmorland, August 21.

The Iron Arc.

WHILE carrying on some experiments with the electric arc between iron electrodes, one of my students, Mr. H. D. Arnold, noticed that there was a certain critical P.D. at which an abrupt change took place in the conditions of the arc. Subsequent investigation has shown that the effect is closely analogous to the "hissing point" of the carbon arc. How close the analogy is may be seen from the following remarks. If the iron arc is started with a large external resistance and maintained at such a length that the current is well below one ampere, it burns with little or no sound, and its appearance in the neighbourhood of the anode is very diffuse and ill-defined. As the external resistance is gradually decreased, the P.D. falls and the current rises until a certain critical value, depending on the length of arc and size of electrodes, is reached. At this point a very small decrease in external resistance suffices to cause a sudden increase in current and drop in P.D., precisely as with the carbon arc. At the same time the arc contracts, a bright spot appears on the anode, and a characteristic hissing sound begins. Further increase of current is accompanied by a *continued decrease* in P.D. The hissing stage, in fact, begins at quite a different point on the P.D.-current diagram from that in the case of the carbon arc. If the experiment is carried out in the reverse order, starting with a large current, the discontinuity is encountered again, but not until the current has been diminished beyond the value that it had at the beginning of the hissing stage. Indeed, with arcs of 6 mm. and more, the current on the hissing stage can with care be decreased until it is smaller than its previous largest value on the quiet stage. Thus there are two possible values of P.D. for the same current and length of arc, one corresponding to the quiet, the other to the hissing stage.

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